

AN ILLUSTRATED KEY TO SOME COMMON AUSTRALIAN CULICINE MOSQUITO LARVAE, WITH NOTES ON THE MORPHOLOGY AND BREEDING PLACES.

By A. R. WOODHILL and G. PASFIELD, Department of Zoology, University of Sydney.*

(Eleven Text-figures.)

[Read 27th August, 1941.]

Introduction.

In any scheme of mosquito control it is essential to determine the species present in the area under consideration. This may be done by identifying either the larvae or adults, but breeding out the adults requires time and special equipment which is not always available, and the work is greatly facilitated if an immediate determination of the larvae can be made. The aim of the present paper is to enable such a determination to be made by an examination of the 4th stage larvae under a binocular microscope, without the necessity of making a special preparation or obtaining a cast skin. The only previous work of this type in Australia is that by Cooling (1924), but no key is given and the illustrations are not accurate. The value of the key is necessarily lessened by the fact that it includes only a small proportion of the described Australian species, but it includes most of the commoner species with the exception of *A. (O.) vittiger* Skuse and *A. (O.) theobaldi* Taylor. Any species not included in the key should be easily recognized as such by comparison with the drawings and descriptions.

Keys to the adult mosquitoes of the Australasian region have been published by Edwards (1924). A key to the Australian species of Anopheline larvae and adults has been published by Mackerras (1927), while Taylor (1927) has described the species of Anophelinae and given an account of their bionomics. With regard to the relation of mosquitoes of the Australian region to human disease, Taylor (1938) should be consulted.

The notes given here on the breeding places include much material already published by Taylor (1928, 1938), Mackerras (1926), Hamlyn-Harris (1927, 1929) and Woodhill (1936, 1938), together with observations made by the senior author. The nomenclature used throughout is that given by Taylor (1934).

Species of Larvae Figured and Described.

Aedes (Stegomyia) aegypti Linnaeus, *A. (Finlaya) notoscriptus* Skuse, *A. (F.) alboannulatus* Macquart, *A. (Ochlerotatus) vigilax* Skuse, *A. (Pseudoskusea) concolor* Taylor, *A. (Mucidus) alternans* Westwood, *Megarhinus speciosus* Skuse, *Culex (Culex) annulirostris* Skuse and *C. (C.) fatigans* Wiedemann are figured and described.

Morphological Features of 8th and 9th Segments in Culicine Larvae. (Fig. 1.)

The following terminology is that used by Marshall (1938) with some slight modifications and additions. The 8th segment bears on each side a series of irregularly placed scales, known as the *lateral comb*, and posterior to this, five hair tufts, the *pentad hairs*, which are designated α , β , γ , δ , ϵ , as in Fig. 1. The pentad hairs may be single hairs or multiple tufts, and may be either simple or plumose.

Articulating with the 8th segment, in a posterior dorsal position, is a chitinized tubular structure known as the *siphon*. The length of this structure (exclusive of the

* The services of the junior author were made available by the University of Sydney as the result of a grant from the Commonwealth Government Research Fund.

valves) divided by the width at the base is known as the *siphonal index*, but this figure may vary somewhat within a single species. A projection occurs on each side of the base of the siphon, and the term *baso-siphonal projection* is proposed for this structure.

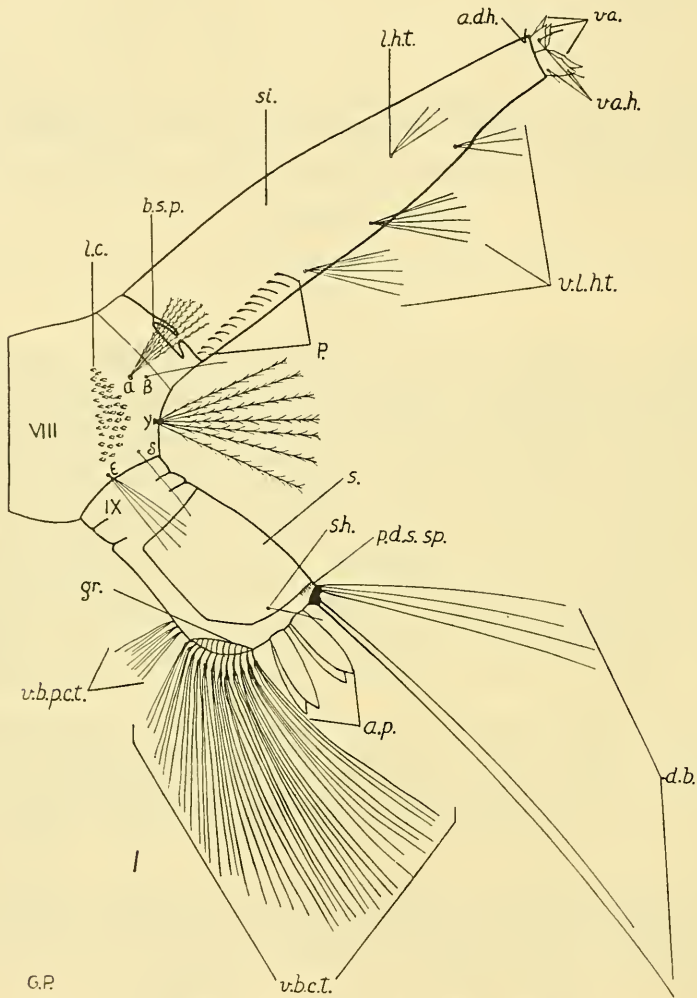


Fig. 1.—Morphological features of terminal segments of Culicine mosquito larvae. VIII, eighth segment; IX, ninth segment; *a.d.h.*, apico-dorsal hair; *a.p.*, anal papillae; *a*, *β*, *γ*, *δ*, *ε*, pentad hairs; *b.s.p.*, baso-siphonal projection; *d.b.*, dorsal brush; *gr.*, grid; *l.c.*, lateral comb; *l.h.t.*, lateral siphonal hair tuft; *p.*, pecten; *p.d.s.sp.*, posterior dorsal saddle spines; *s.*, saddle; *s.h.*, saddle hair; *si.*, siphon; *va.*, valves; *va.h.*, valve hairs; *v.b.c.t.*, cratal hairs of ventral brush; *v.b.p.c.t.*, pre-cratal hairs of ventral brush; *v.l.h.t.*, ventro-lateral siphonal hair tufts.

On each side of the basal half of the siphon, in a ventro-lateral position, is a row of spines known as the *pecten*. A varying number of *siphonal hair tufts* also occur on each side of the siphon, and these are known as the *ventro-lateral hair tufts*, and *lateral hair tufts* according to their position. In some species a single row of dorsal or ventral median hair tufts occurs.

Articulating apically with the siphon are five *valves*, consisting of a ventral pair, a latero-dorsal pair, and one medio-dorsal valve. These carry minute hairs or hair tufts known as the *valve hairs*. On each side of the siphon, anterior to the latero-dorsal valves, is a small hair, known as the *apico-dorsal hair*.

The 9th segment carries a chitinous plate known as the *saddle*. This may occupy only a small area on the dorsal aspect of the segment, or may extend almost to the mid-ventral line, or may completely surround the segment as a continuous ring. Frequently the saddle bears minute spines on its posterior dorsal margin. The *saddle hair* is borne near the posterior margin of the saddle, and may sometimes take the form of a hair tuft consisting of two or more hairs. A series of long paired hairs or hair tufts arising from small chitinous bosses on the posterior dorsal aspect of the 9th segment, is known as the *dorsal brush*. A row of hair tufts projecting posteriorly and ventrally in a median position is known as the *ventral brush*. The ventral brush includes what are termed the *cratal* and *pre-cratal hair tufts*. The cratal tufts arise from a structure known as the *grid*, which consists of a series of chitinous transverse bars enclosed by a chitinous border, the whole having a grid-like appearance. The pre-cratal tufts arise anteriorly to the grid and are usually much shorter than the cratal tufts.

The 9th segment bears at its apex two pairs of elongated thin-walled structures known as the *anal papillae*. Between the bases of the papillae is the anal opening. What is known as the *gill saddle index* is the figure given by dividing the length of the anal papillae by the length of the saddle at its longest part. This figure is not very reliable, as the length of the papillae may vary according to the chemical composition of the water.

Explanation of Figures.

In all the figures in the present paper the paired structures on the 8th segment and on the siphon are shown for one side only, in order to avoid confusion. Where a hair tuft is not on the median ventral or dorsal line, this is clearly indicated by the fact that its base is situated within the outline of the drawing. Any structures shown as arising from the margin can be taken as being on, or very close to, the median line.

N.B.—The hairs of the dorsal brush actually arise on each side of the median line, but very close to it, and in the drawings *all* the hairs of the dorsal brush are shown.

The transverse line shown below the siphon, indicates a fold in the cuticle produced by the movement of the siphon, but in some specimens this is not very clearly defined and it is never as distinct as the division between the 8th and 9th segments.

The number of pecten spines, lateral scales, and hairs in the various tufts, represents an average of a large number of specimens, the maximum and minimum number observed being given in the description.

With regard to the hair tufts, these are noted as being plumose when the plumosity is plainly visible under a magnification of 60. In some cases a very fine plumosity is visible under a much higher magnification, but this is not described as such.

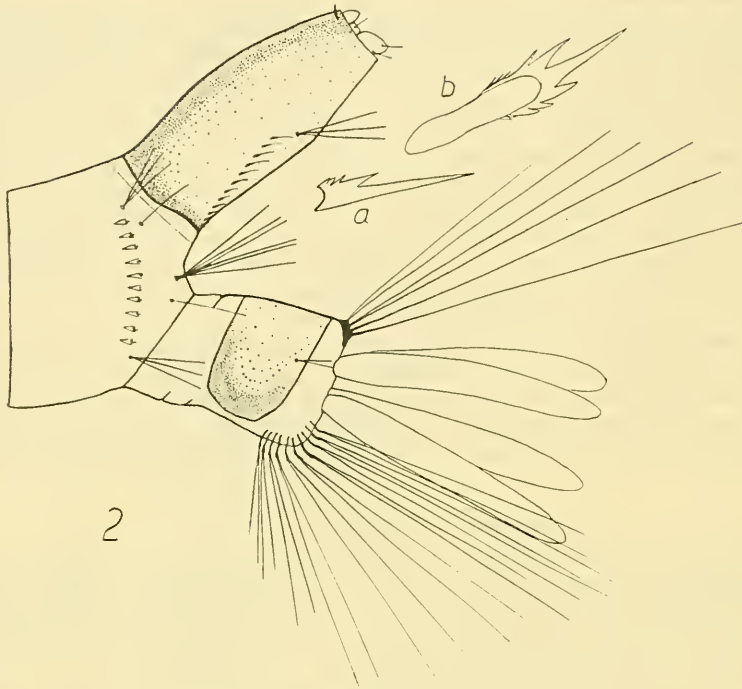
It will be noted that in the drawings the teeth of the pecten spines are sometimes shown on the left and sometimes on the right hand side of the spine. This has no significance, since it is due entirely to the position of the siphon varying in the different preparations. In all the species examined the teeth occur on the side of the spine which faces towards the base of the siphon.

It would appear that some at least of the variations shown by authors in the pecten spines and comb scales are due to the angle from which these are viewed. While it is possible to distinguish the genera *Aedes* and *Culex* by an examination of the pecten spines and lateral comb scales, some of the species of *Aedes* dealt with in this paper definitely cannot be distinguished by these structures alone.

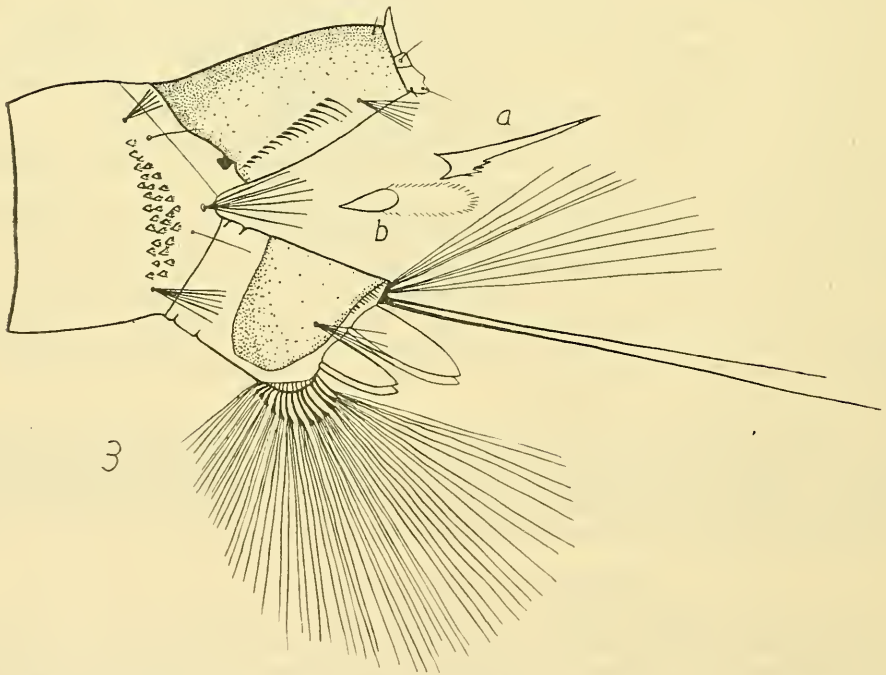
DESCRIPTION OF TERMINAL SEGMENTS.

AÈDES (STEGOMYIA) AEGYPTI Linnaeus. Fig. 2.

Lateral Comb. 7 to 12 elongated scales in a single row. *Pentad hairs.* α , 3 to 5; β , 1; γ , 4 to 8; δ , 1; ϵ , 2 to 4; γ sometimes weakly plumose, remainder always non-plumose. *Siphon.* Siphonal index approx. 2.4. *Baso-siphonal projection.* Absent. *Pecten.* 13 to 18 spines. *Apico-dorsal hairs.* A pair of small single hairs. *Valve hairs.* Each ventral valve with a single hair at apex and base, and latero-dorsal valves each with a single hair. *Siphonal hair tufts.* One pair of ventro-lateral non-plumose hair tufts, each of 2 to 4 hairs. *Saddle.* Short, as in Fig. 2, extending almost to mid-ventral line.



2



3

Fig. 2.—*Aedes (Stegomyia) aegypti* Linnaeus $\times 42$. *a*, pecten spine $\times 335$; *b*, lateral comb scale $\times 335$.

Fig. 3.—*Aedes (Finlaya) notoscriptus* Skuse $\times 42$. *a*, pecten spine $\times 335$; *b*, lateral comb scale $\times 335$.

Saddle hairs. 1, or a tuft of 2, on each side. *Dorsal brush.* One pair of single hairs, and a pair of tufts each composed of 2 to 4 hairs. Total variation in dorsal brush 6 to 10. *Ventral brush.* 9 to 10 tufts of 2 hairs each. The grid is imperfectly developed, having transverse bars but no chitinous border. *Anal papillae.* Usually about three times as long as saddle, blunt at apex. *Pecten spines and comb scales.* As in Fig. 2, with slight variations.

Breeding Places.—This is one of the common domestic species, always breeding in or near human dwellings in artificial containers or tree holes. It does not usually occur in ground water, and should therefore be one of the easiest species to control. It rarely occurs in very foul water.

AËDES (FINLAYA) NOTOSCRIPATUS Skuse. Fig. 3.

Lateral comb. Approx. 22 to 36 rather elongated scales, in 3 to 4 irregular rows. *Pentad hairs.* α , 3 to 6; β , 1; γ , 4 to 7; δ , 1; ϵ , 4 to 8; normally these hairs are non-plumose, but an occasional specimen shows plumosity on γ . *Siphon.* Siphonal index approx. 1.8. *Baso-siphonal projection.* Distinct and roughly rectangular as in Fig. 3. *Pecten.* 12 to 18 spines. *Apico-dorsal hairs.* A pair of single hairs. *Valve hairs.* Two single hairs present on each of the ventral valves and one on each of the latero-dorsal valves. *Siphonal hair tufts.* One pair of ventro-lateral tufts consisting of 2 to 6 non-plumose hairs. Occasionally a very fine plumosity occurs on these hairs. *Saddle.* Extends almost to the mid-ventral line and carries distinct spines on its posterior dorsal margin. *Saddle hairs.* A tuft of 3 to 5 non-plumose hairs on each side. *Dorsal brush.* One pair of long single hairs, and a pair of shorter hair tufts each composed of 4 to 6 hairs. *Ventral brush.* 12 to 14 cratal tufts, arising from a well-marked grid, each tuft consisting of from 4 to 7 hairs. *Anal papillae.* One pair about as long as the saddle, the other pair frequently shorter. *Pecten spines and comb scales.* As in Fig. 3, with slight variations.

Breeding Places.—This species occurs in freshwater rock holes, tree holes, and in artificial containers. It is a very common domestic species, as well as occurring in the field.

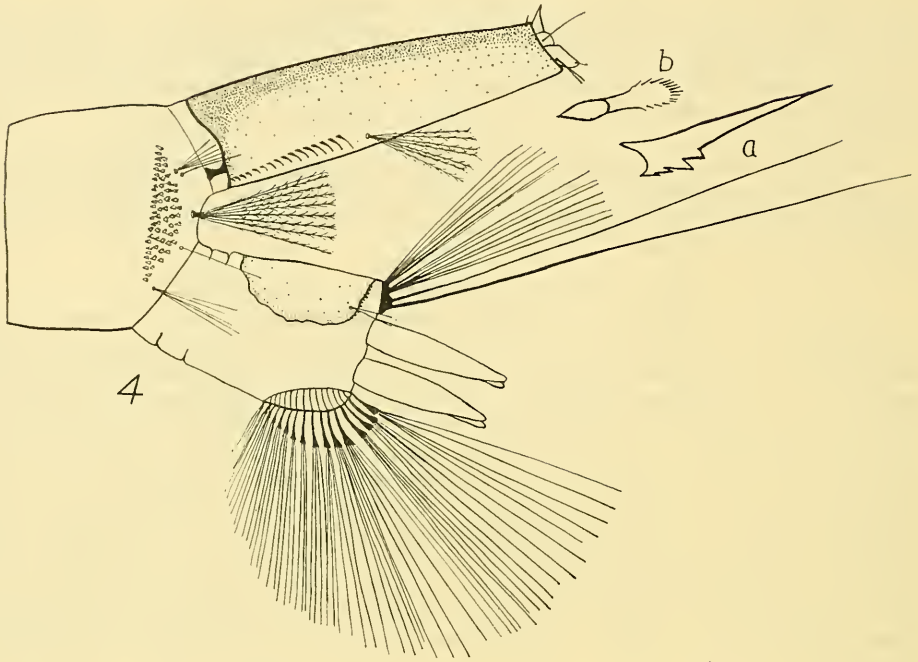
AËDES (FINLAYA) ALBOANNULATUS Macquart. Fig. 4.

Lateral comb. Approx. 60 to 105 elongated scales, in 4 to 5 irregular rows. *Pentad hairs.* α , 2 to 6; β , 1; γ , 9 to 15; δ , 1; ϵ , 5 to 9; γ distinctly plumose and remainder non-plumose. *Siphon.* Siphonal index approx. 3.6. *Baso-siphonal projection.* Longer than wide and narrower in centre than at apex, as in Fig. 4. *Pecten.* 15 to 32 spines. *Apico-dorsal hairs.* Present as a pair of small single hairs. *Valve hairs.* Each ventral valve bears a small hair at its apex, and at its base, either a single hair or a tuft of 2 or 3 larger hairs. Each latero-dorsal valve bears either a single or double hair. *Siphonal hair tufts.* One pair of ventro-lateral hair tufts of 7 to 12 hairs, distinctly plumose. In 2 specimens out of 50 examined, three pairs of very minute hair tufts, each consisting of 2 hairs, were observed in a dorso-lateral position on the siphon. *Saddle.* Extends slightly less than half the distance from the mid-dorsal to the mid-ventral line, and shows very minute projections on its posterior margin. *Saddle hairs.* May be single, or a tuft of 2 or 3 non-plumose hairs on each side. *Dorsal brush.* One pair of long single hairs, and a pair of shorter hair tufts each composed of 6 to 11 hairs. *Ventral brush.* 14 to 18 cratal tufts of 6 to 12 hairs, arising from a well-marked grid. *Anal papillae.* Slightly longer than the saddle. *Pecten spines and comb scales.* As in Fig. 4, with slight variations.

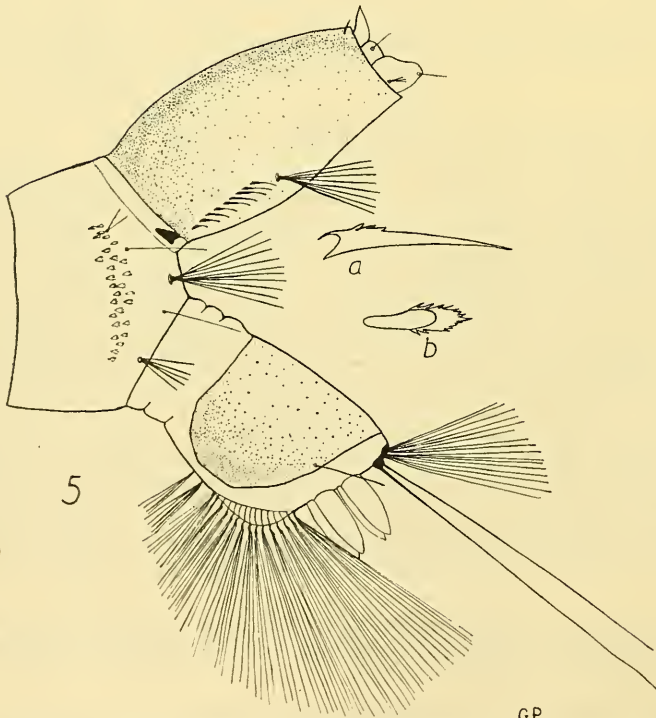
Breeding Places.—This is one of the commonest species found in freshwater rock pools, and also occurs in freshwater swamps and soakings, but has not been recorded as breeding in artificial containers in or near dwellings.

AËDES (OCHLEROTATUS) VIGILAX Skuse. Fig. 5.

Lateral comb. Approx. 19 to 28 scales in 2 to 3 irregular rows. *Pentad hairs.* α , 2 to 4; β , 1; γ , 6 to 10; δ , 1; ϵ , 3 to 5; in the majority of specimens all these hair tufts are non-plumose, but a small percentage shows plumosity on γ . *Siphon.* Siphonal index approx. 2.3. *Baso-siphonal projection.* Wider at apex than base, as in Fig. 5. *Pecten.*



4



5

G.P.

Fig. 4.—*Aedes (Finlaya) alboannulatus* Macquart $\times 42$. *a*, pecten spine $\times 335$; *b*, lateral comb scale $\times 335$.

Fig. 5.—*Aedes (Ochlerotatus) vigilax* Skuse $\times 42$. *a*, pecten spine $\times 335$; *b*, lateral comb scale $\times 335$.

5 to 11 spines. *Apico-dorsal hairs*. A pair of small single hairs. *Valve hairs*. Each ventral valve bears a single hair at its apex, and at its base a tuft of 3 hairs. Each latero-dorsal valve bears a single hair. *Siphonal hair tufts*. One pair of ventro-lateral hair tufts of 8 to 12 hairs, usually non-plumose but occasionally showing some plumosity varying from very fine to quite obvious. *Saddle*. Extends nearly to mid-ventral line, with no spines visible under the binocular microscope. *Saddle hairs*. Either a single hair on each side, or absent. *Dorsal brush*. One pair of long single hairs, and a pair of shorter hair tufts each composed of 6 to 9 hairs. *Ventral brush*. 14 to 16 cratal tufts each of 4 to 9 hairs, arising from a well-marked grid, and either 1 or 2 pre-cratal tufts of 4 to 5 hairs each. *Anal papillae*. Slightly less than half the length of the saddle. *Pecten spines and comb scales*. As in Fig. 5, with slight variations.

Breeding Places.—This species breeds in enormous numbers in salt or brackish muddy pools at the margin of tidal swamps, but not in the portion of the swamp where tidal water runs in and out daily. An outbreak of this species is often associated with exceptionally high tides. It has also been recorded breeding in swampy freshwater pools, but has not been found breeding in large numbers in inland districts.

AÈDES (PSEUDOSKUSEA) CONCOLOR Taylor. Fig. 6.

Lateral comb. Approx. 90 to 110 small scales, in 8 to 9 irregular rows. *Pentad hairs*. α , usually absent, occasionally present as a tuft of 2 very small hairs; β , 2 to 3; γ , 6 to 12; δ , 1 to 4; ϵ , 2 to 5; γ well developed and plumose, remainder simple and weakly developed. *Siphon*. Siphonal index approx. 2.1. *Baso-siphonal projection*. Absent. *Pecten*. 8 to 18 spines. Frequently the row of spines is not continuous, a small series of 2 to 4 spines at the base of the siphon appearing as a separate clump. *Apico-dorsal hairs*.

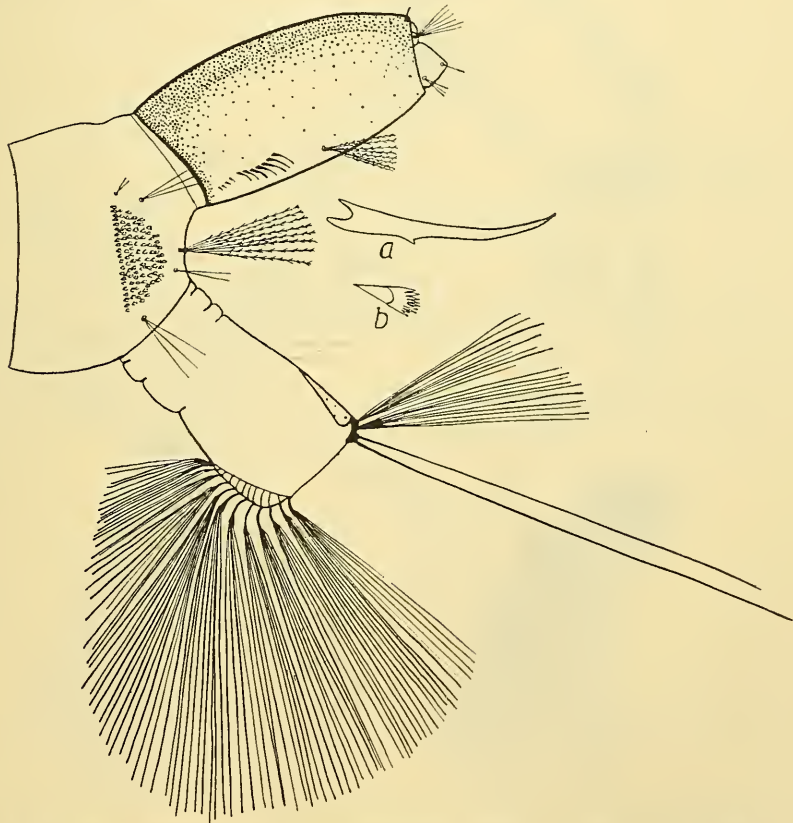


Fig. 6.—*Aedes (Pseudoskusea) concolor* Taylor $\times 42$. *a*, pecten spine $\times 335$; *b*, lateral comb scale $\times 335$.

A well-developed single hair on each side. *Valve hairs*. Each ventral valve bears at its apex 1 to 2 hairs, and at its base a tuft of 2 to 6 hairs. The latero-dorsal valves bear a tuft of 3 to 6 hairs. *Siphonal hair tufts*. One pair of ventro-lateral plumose tufts of 4 to 12 hairs. *Saddle*. Extremely small, extending less than half-way to the base of the segment, and less than one-quarter of the distance from the mid-dorsal to the mid-ventral line. *Saddle hairs*. Absent. *Dorsal brush*. One pair of long single hairs, and a pair of shorter tufts each of 8 to 10 hairs. *Ventral brush*. 12 to 16 cratal tufts of 8 to 9 hairs, arising from a well-marked grid. *Anal papillae*. Absent. When the rectum is protruded four small rounded internal papillae are just visible, as previously described (Woodhill, 1938). *Pecten spines and comb scales*. As in Fig. 6, with slight variations.

Breeding Places.—This species breeds only in salt or brackish rock pools at or slightly above high-tide mark (Woodhill, 1936).

AËDES (MUCIDUS) ALTERNANS Westwood. Fig. 7.

Unfortunately sufficient material of this species was not available, so that it was not possible to determine the range of variation in the various structures, and the following description is based on a few specimens only.

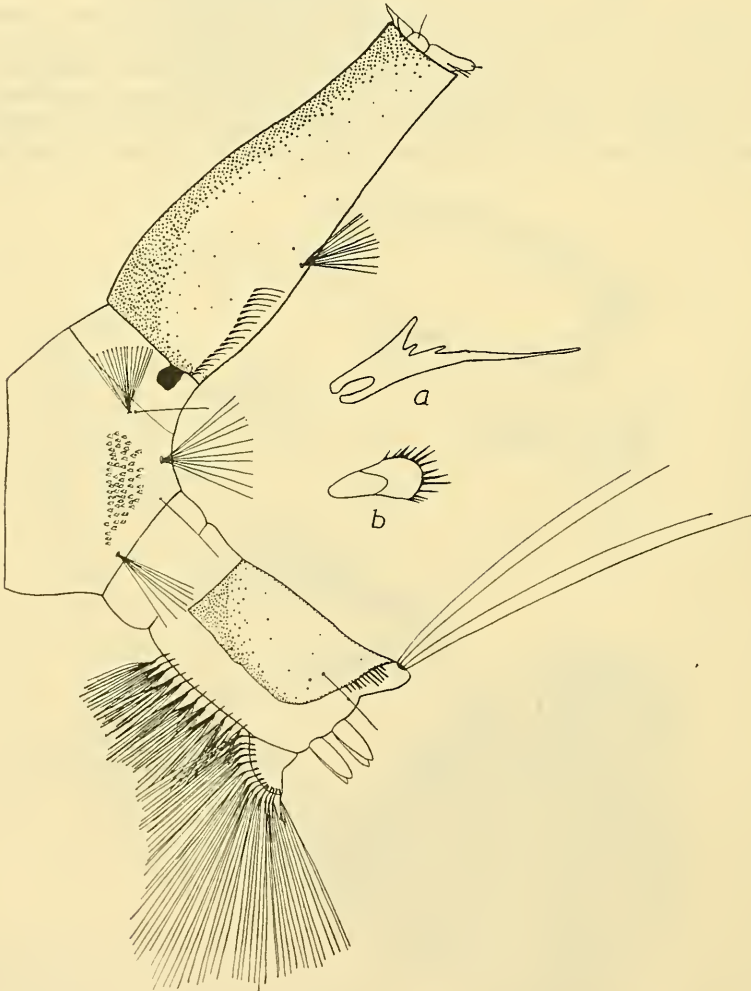


Fig. 7.—*Aedes (Mucidus) alternans* Westwood $\times 27$. a, pecten spine $\times 335$; b, lateral comb scale $\times 335$.

Lateral comb. Approx. 60 scales in 4 to 5 irregular rows. *Pentad hairs.* Approx. numbers, α , 16; β , 1; γ , 10; δ , 1; ϵ , 7; all tufts non-plumose. *Siphon.* Siphonal index approx. 3.1. *Baso-siphonal projection.* Roughly rectangular, and not markedly constricted at base, as in Fig. 7. *Pecten.* Approx. 16 spines. *Apico-dorsal hairs.* A small single hair on each side, often situated on the apical margin. *Valve hairs.* Each ventral valve bears a single hair at its apex and a double hair at its base, and each latero-dorsal valve bears a single hair. *Siphonal hair tufts.* One pair of ventro-lateral hair tufts, each tuft having approx. 11 non-plumose hairs. *Saddle.* Extends approx. two-thirds of the distance from the apex to the base of the segment, and approx. two-thirds of the distance from the mid-dorsal to the mid-ventral line, and bears pronounced spines on its posterior dorsal margin. *Saddle hairs.* A single well-developed hair on each side. *Dorsal brush.* Two pairs of single hairs. *Ventral brush.* In the position in which the grid is usually found a projection occurs, on which are borne approx. 15 tufts, each of 5 or 6 hairs. In shrunken specimens this projection is withdrawn. In

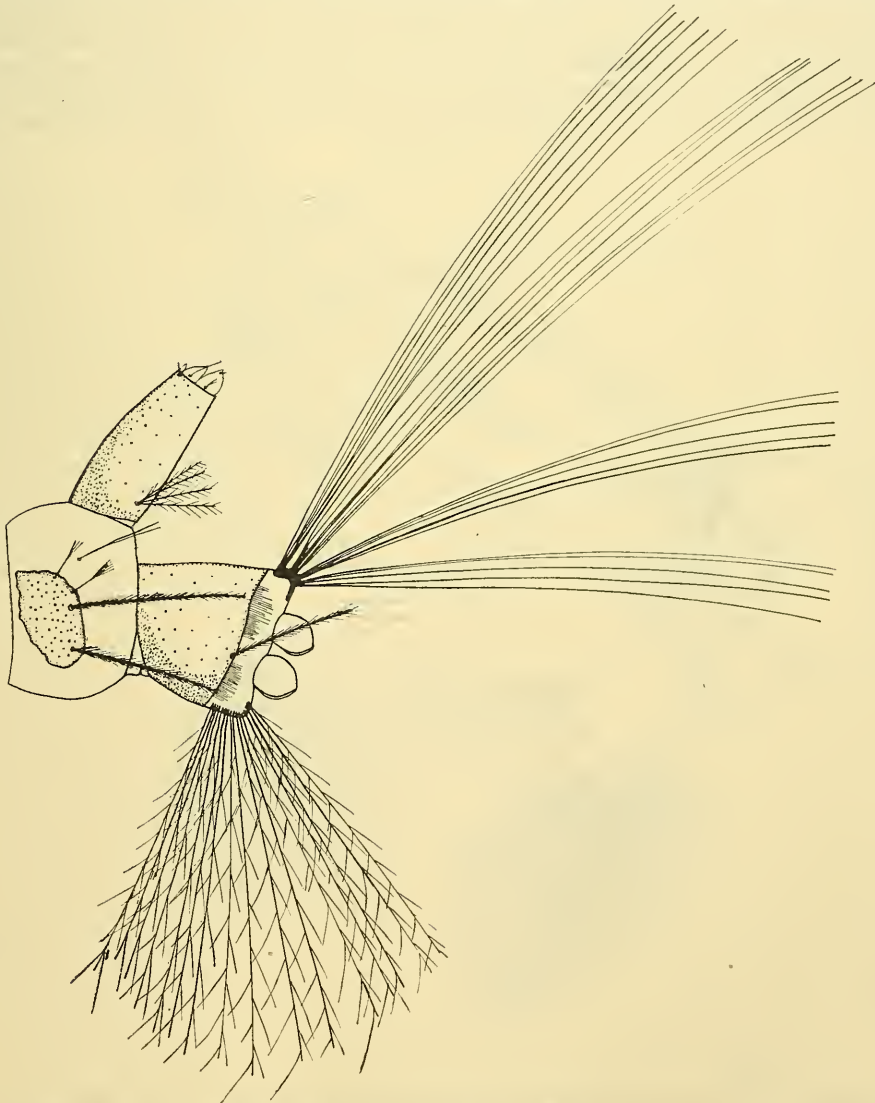


Fig. 8.—*Megarhinus speciosus* Skuse $\times 17$.

addition a series of 12 hair tufts, each of 5 to 7 hairs, extends along the ventral margin to a point in line with the anterior margin of the saddle. All of these 27 hair tufts arise from transverse chitinous bars, but there is no chitinous border, hence the structure cannot accurately be described as a grid. *Anal papillae*. Very small, narrow and pointed, approx. 0.3 times as long as the saddle. *Pecten spines and comb scales*. As in Fig. 7, with slight variations.

Breeding Places.—This species breeds in swamps or swampy pools, which may be either salt (Mackerras, 1926, Cooling, 1924), or fresh, and it occurs in both coastal and inland areas. The larvae are predacious, feeding on other mosquito larvae.

MEGARIINUS SPECIOSUS Skuse. Fig. 8.

Lateral comb. Absent. Situated somewhat anteriorly to the normal position of the lateral comb is a chitinized pigmented plate, bearing 2 small hairs, which may either be simple or may have up to 6 small branches at their apices, and 2 very large single plumose hairs, as in Fig. 8. *Pentad hairs*. These are represented by 1 hair tuft only, of 1 to 3 hairs. This may be the equivalent of either α or β . *Siphon*. Siphonal index approx. 2.3. *Baso-siphonal projection*. Absent. *Pecten*. Absent. *Apico-dorsal hairs*. A small single hair on each side. *Valve hairs*. Each ventral valve bears a single hair at the apex and a tuft of 2 to 3 hairs at the base, and each latero-dorsal valve bears a single hair. *Siphonal hair tufts*. One pair of ventro-lateral tufts, each tuft bearing 2 to 6

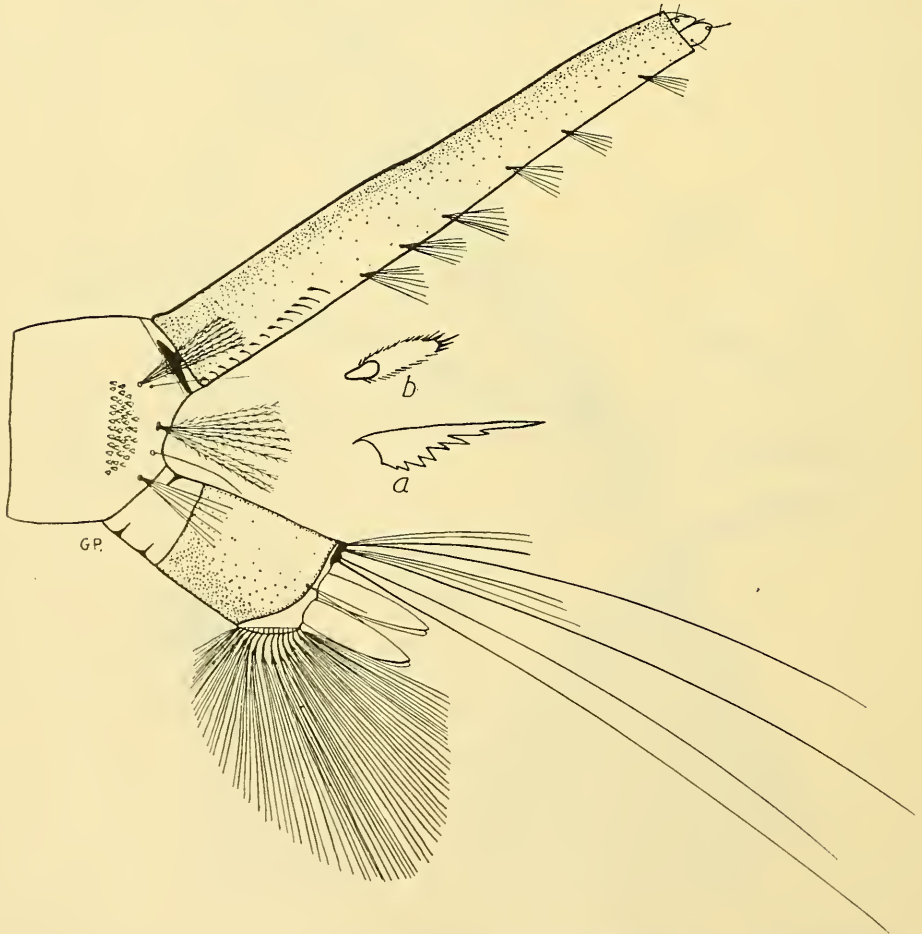


Fig. 9.—*Culex (Culex) annulirostris* Skuse $\times 42$. *a*, pecten spine $\times 335$; *b*, lateral comb scale $\times 335$.

plumose hairs. *Saddle*. Forms a complete ring round the terminal segment and dorsally extends to the base of the segment. The posterior lateral margin of the saddle bears a row of conspicuous spines. *Saddle hair*. A single large plumose hair on each side. *Dorsal brush*. Two pairs of hair tufts, the ventral tufts bearing 3 to 5 hairs each and the dorsal tufts 5 to 8 hairs. *Ventral brush*. 10 to 18 long single plumose hairs. These hairs arise from the normal position of the cratal hairs but can hardly be described under that term, since they arise from chitinous bands without the chitinous margin, so that a true grid is not formed. *Anal papillae*. Short and rounded, approx. 0.3 times as long as the saddle.

Breeding Places.—These larvae occur in artificial containers, rain-water tanks, etc., and in tree holes, and are predacious on other species of mosquito larvae.

CULEX (CULEX) ANNULIROSTRIS Skuse. Fig. 9.

Lateral comb. Approx. 35 to 55 scales in 4 to 5 irregular rows. *Pentad hairs*. α , 4 to 7; β , 1; γ , 7 to 10; δ , 1; ϵ , 5 to 7; α and γ plumose, remainder simple. *Siphon*. Siphonal index approx. 7.2. *Baso-siphonal projection*. Very wide, and strongly constricted

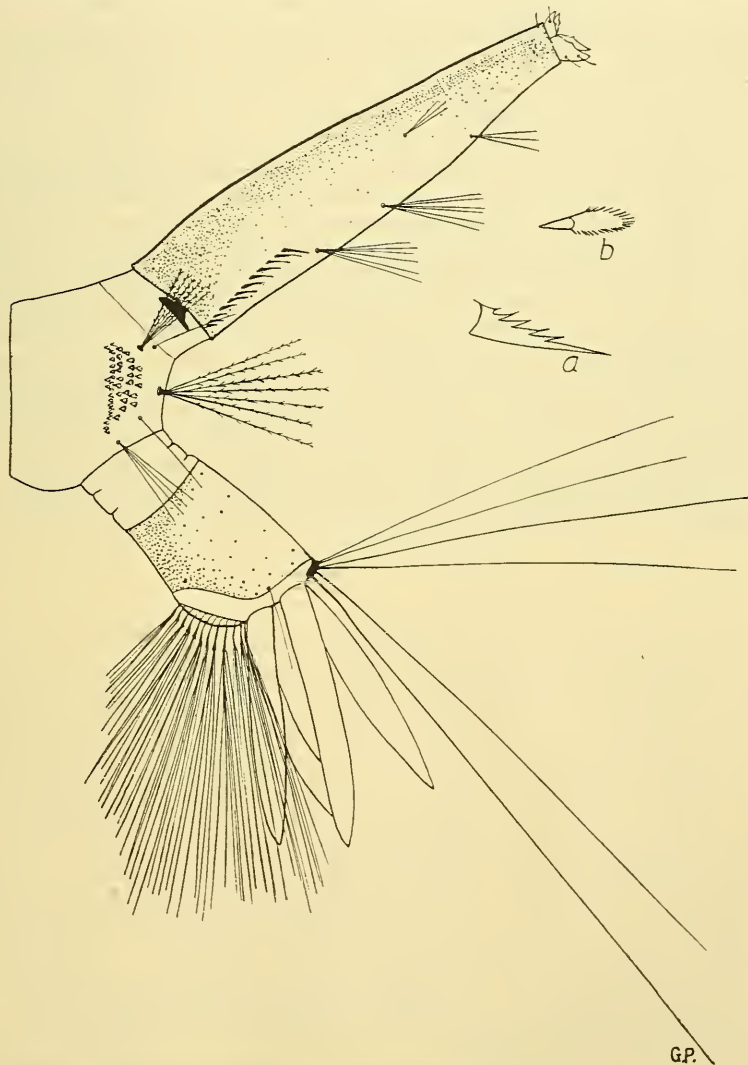


Fig. 10.—*Culex (Culex) fatigans* Wiedemann $\times 42$. *a*, pecten spine $\times 335$; *b*, lateral comb scale $\times 335$.

at base as in Fig. 9. *Pecten*. 11 to 15 spines. *Apico-dorsal hairs*. A small single hair on each side. *Valve hairs*. Each ventral valve bears a single hair at the apex and the base, and each latero-dorsal valve bears a single hair. A single hair arises from the inner margin of the base of the medio-dorsal valve. *Siphonal hair tufts*. Six pairs of non-plumose ventro-lateral hair tufts, the number of hairs in each tuft varying from 3 to 9. *Saddle*. Forms a complete ring round the terminal segment. *Saddle hairs*. A tuft of 2 to 4 non-plumose hairs on each side. *Dorsal brush*. Two pairs of long single hairs, and 1 pair of shorter tufts, each tuft consisting of 3 to 4 hairs. *Ventral brush*. 12 to 14 cratal tufts, each of 7 to 8 hairs, arising from a well-marked grid. *Anal papillae*. From 0.6 to 0.8 times as long as the saddle. *Pecten spines and comb scales*. As in Fig. 9, with slight variations.

Breeding Places.—These larvae occur in fresh and brackish pools, or swamps, and are found in both inland and coastal districts. The larval stage of this mosquito has never been clearly differentiated from that of *Culex (Culex) sitiens* Wiedemann, which is stated to breed only in salt-water.

CULEX (CULEX) FATIGANS Wiedemann. Figs. 10, 11.

Lateral comb. Approx. 30 to 50 scales arranged in 4 to 5 irregular rows. *Pentad hairs*. α , 4 to 7; β , 1; γ , 5 to 9; δ , 1; ϵ , 3 to 6; α and γ plumose, remainder simple. *Siphon*. Siphonal index extremely variable, from 3.4 to 6.5 (Fig. 11). *Baso-siphonal projection*. Very wide and constricted at base, as in Fig. 10. *Pecten*. 8 to 14 spines. *Apico-dorsal hairs*. A small single hair on each side. *Valve hairs*. Each ventral valve bears a single hair at the apex and the base, and each latero-dorsal valve bears a single hair. A single hair arises from the inner margin of the base of the medio-dorsal valve. *Siphonal hair tufts*. Usually 3 pairs of ventro-lateral tufts and 1 pair of lateral tufts, all non-plumose. The two basal pairs of ventro-lateral tufts vary from 3 to 9 hairs each, the apical pair varies from 2 to 4 hairs in each tuft, while the lateral pair varies from 2 to 3 hairs in each tuft. These tufts, however, are variable and there may be 4 pairs of ventro-lateral tufts, or 3 tufts on one side and 4 on the other. The pairs may also be asymmetrically placed. These variations are shown from the ventral aspect in Fig. 11, the position of the tufts being indicated by dots. All variations shown have been found to occur in larvae from a single egg-raft. It is probable also that some larvae showing 2 pairs of lateral tufts are also *C. fatigans*, but this has not yet been definitely confirmed. *Saddle*. Forms a complete ring round the terminal segment. *Saddle hairs*. Either 1 hair or a tuft of 2 hairs, on each side, never plumose. *Dorsal brush*. One pair of long single hairs, and 1 pair of shorter tufts each varying from

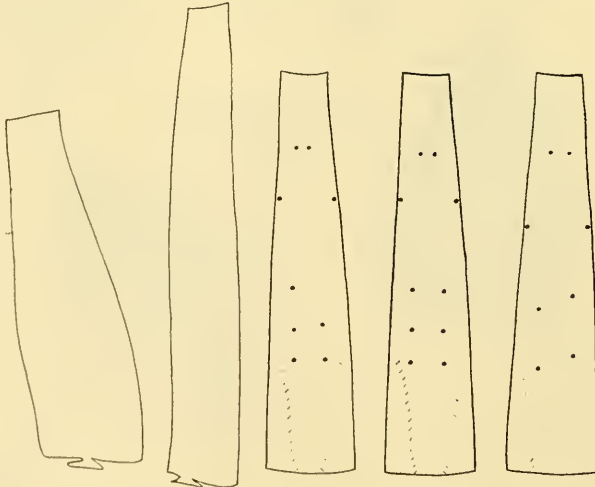


Fig. 11.—*Culex (Culex) fatigans* Wiedemann. Variations in siphonal index and siphonal hair tufts $\times 36$.

2 to 3 hairs. Occasionally one of these shorter tufts may only be represented by a single hair. *Ventral brush*. 10 to 12 cratal tufts, each of 4 to 7 hairs arising from a well-marked grid. *Anal papillae*. Usually about 1.7 times as long as the saddle. *Pecten spines and comb scales*. As in Fig. 10, with slight variations.

Breeding Places.—This is one of the common domestic mosquitoes, always breeding in or near human dwellings. It prefers foul water, but also breeds in clean water, and occurs in ground water as well as in artificial containers, thus differing in its habits from *Aedes (Stegomyia) aegypti* Linnaeus. This species will not develop in water with a salinity greater than 14 gm. of salts per litre (Woodhill, 1938).

Key to Species of Larvae.

1. Siphon with only one pair of hair tufts 2
- Siphon with four or more pairs of hair tufts 8
2. No pecten, no lateral comb, a chitinized plate bearing two large and two small hairs on each side of 8th segment *Megarhinus speciosus* Skuse (Fig. 8)
- Pecten and lateral comb present, no such chitinized plate in 8th segment 3
3. Saddle extending less than half-way from apex to base of 9th segment, and less than one-quarter of the distance from the mid-dorsal to the mid-ventral line *Aedes (Pseudoskusea) concolor* Taylor (Fig. 6)
- Saddle extending at least three-quarters of the way from apex to base of segment, and at least two-fifths of the distance from the mid-dorsal to the mid-ventral line 4
4. Lateral comb, consisting of a single row of seven to twelve scales, baso-siphonal projection absent *Aedes (Stegomyia) aegypti* Linnaeus (Fig. 2)
- Lateral comb of twenty or more scales, arranged in several irregular rows, baso-siphonal projection present 5
5. Tufts of ventral brush extending at least three-quarters of distance from apex to base of 9th segment, posterior tufts of ventral brush rising from a distinct projection, no chitinous margin surrounding transverse bars from which tufts arise *Aedes (Mucidus) alternans* Westwood (Fig. 7)
- Tufts of ventral brush not extending more than half-way from apex to base of 9th segment, posterior tufts not arising from a projection, and a distinct chitinous margin surrounding the transverse bars to form a true grid 6
6. Saddle not extending below the mid-lateral line *Aedes (Finlaya) alboannulatus* Macquart (Fig. 4)
- Saddle extending at least three-quarters of the distance from the mid-dorsal to the mid-ventral line 7
7. One or two pre-cratal tufts present, saddle not bearing posterior dorsal spines *Aedes (Ochlerotatus) vigilax* Skuse (Fig. 5)
- No pre-cratal tufts present, saddle bearing conspicuous posterior dorsal spines *Aedes (Finlaya) notoscriptus* Skuse (Fig. 3)
8. Three or four pairs of ventro-lateral, and one pair of lateral siphonal tufts *Culex (Culex) fatigans* Wiedemann (Figs. 10, 11)
- Six pairs of ventro-lateral, and no lateral siphonal tufts *Culex (Culex) annulirostris* Skuse (Fig. 9)

References.

- COOLING, L. E., 1924.—Larval Stages and Biology of the Commoner Species of Australian Mosquitoes. *Commonw. Aust. Dept. Hlth. Serv. Publ. (Trop. Div.)*, No. 8.
- EDWARDS, F. W., 1924.—A Synopsis of the Adult Mosquitoes of the Australasian Region. *Bull. Ent. Res.*, 14 (4), 351-401.
- HAMLIN-HARRIS, R., 1927.—Notes on the Breeding Places of Two Mosquitoes in Queensland. *Bull. Ent. Res.*, 17 (4), 411-414.
- , 1929.—Notes on the Breeding Places of *Aedes (F.) notoscriptus* Skuse in Queensland. *Bull. Ent. Res.*, 19 (4), 405-409.
- HILL, G. F., 1922.—Habits and Distribution of Some North Australian Culicidae. *Commonw. Aust. Dept. Hlth. Serv. Publ.* No. 21.
- MACKERRAS, I. M., 1926.—Mosquitoes of the Sydney District. *Aust. Naturalist*, 6 (3), 33-42.
- , 1927.—Notes on Australian Mosquitoes. Pt. i. The Anophelini of the Mainland. *Proc. Linn. Soc. N.S.W.*, lii (2), 33-41.
- MARSHALL, J. F., 1938.—The British Mosquitoes. *Brit. Mus. Nat. Hist.* Wm. Clowes & Sons Ltd., London.
- TAYLOR, F. H., 1927.—The Anopheles of the Australian Region, their Bionomics and Distribution. *Trans. Far East. Ass. Trop. Med.*, 3, 143-164.
- , 1928.—Notes on the Life-history and Habits of some Australian Mosquitoes. *Health, Melbourne*, 6 (1), 1-5.
- , 1934.—A Check List of the Culicidae of the Australian Region. *Commonw. Aust., Dept. Hlth. Serv. Publ. (Sch. Publ. Hlth. and Trop. Med.)*, No. 1.

- TAYLOR, F. H., 1938.—Intermediary Arthropod Hosts and Mechanical Carriers of Human Disease in the Australian Region. *Health*, Melbourne, 16 (8), 72-82.
- WOODHILL, A. R., 1936.—Observations and Experiments on *Aedes (P.) concolor* Taylor. *Bull. Ent. Res.*, 27 (4), 633-648.
- , 1938.—Salinity Tolerance and pH Range of *Culex (C.) fatigans* Wied., with Notes on the Anal Papillae of Salt-water Mosquitoes. *Proc. Linn. Soc. N.S.W.*, lxxiii (4), 273-281.
-